

Characteristics of assistance to trauma victims admitted to an emergency room via air medical transport

Características dos atendimentos às vítimas de trauma admitidas em um pronto socorro via transporte aéreo

Características de la atención a víctimas de traumas admitidos en el servicio de urgencias vía transporte aéreo

ABSTRACT

Objective: To describe the characteristics of care provided to trauma victims admitted to an emergency room (ER) by air medical transport. **Method:** 107 medical records were collected and submitted to descriptive statistical analysis. **Results:** Prevalence of male individuals (63.3%), at a median age of 32 years (IQR: 23-51), car crash as a trauma mechanism (28.0%), public air transport (86.0%), and emergency priority level (55.7%). Upon admission, 55.0% had airway prosthesis, 68.2% received supplemental oxygen and 85.0% were immobilized on a long backboard. Limbs (66.3%) and skull (57.9%) were the most affected body regions. Tomography was performed in 72.9%. 60.7% received surgical treatment while 12.1% died in the ER. Length of hospital stay was seven days (IQR: 1.5 -33.0). More than half were discharged (57.0%) and 26.2% died. **Conclusion:** Trauma victims admitted via air medical transport were mostly in serious condition and demanded immediate, specialized care, including highly complex care.

Descriptors: Advanced Trauma Life Support Care; Air Ambulances; Emergency Medical Services; Emergency Nursing.

RESUMO

Objetivo: Descrever as características dos atendimentos às vítimas de trauma admitidas em um pronto socorro de grande porte, via transporte aéreo. **Método:** Estudo transversal que analisou 107 prontuários de vítimas de trauma admitidas via transporte aéreo. Os dados foram submetidos à análise estatística descritiva. **Resultados:** Predominou o sexo masculino (63,3%), mediana de idade de 32 anos (IQ:23-51), vítimas de colisão automobilística (28,0%), transportadas por serviço aéreo público (86,0%) e nível de prioridade vermelho (55,7%). À admissão, 55,0% possuíam prótese de vias aéreas e 57,9% tiveram lesão na região do crânio. 72,9% realizou tomografia, 60,7% recebeu tratamento cirúrgico e 12,1% evoluiu a óbito no pronto socorro. O tempo de internação hospitalar teve mediana de sete dias (IQ: 1,5 -33,0), 57,0% recebeu alta domiciliar e 26,2% evoluiu a óbito. **Conclusão:** As vítimas, maioritariamente, eram graves e demandaram atendimento imediato e especializado, incluindo propedêuticas e terapêuticas de alta complexidade.

Descritores: Cuidados de Suporte Avançado de Vida no Trauma; Resgate Aéreo; Serviços Médicos de Emergência; Enfermagem em Emergência.

RESUMEN

Objetivo: Describir las características de la atención a las víctimas de trauma admitidas en un servicio de urgencias vía transporte aéreo. **Método:** Este estudio transversal analizó 107 historias clínicas de pacientes víctimas de trauma, admitidos en un servicio de urgencias vía transporte aéreo. **Resultados:** Predominó el sexo masculino (63,3%), edad mediana de 32 años (IQ:23-51), colisión automovilística como mecanismo de lesión (28,0%), transporte por servicio aéreo público (86,0%) y nivel de prioridad emergencia (55,7%). En la admisión, 55,0% tenían prótesis de vía aérea, 68,2% recibían oxígeno suplementario y 85,0% estaban inmovilizados en tablas largas. Los miembros (66,3%) y cráneo (57,9%) fueron las regiones corporales más afectadas. La tomografía fue realizada en 72,9%, 60,7% recibió tratamiento quirúrgico y 12,1% evolucionaron a óbito. El tiempo de internación fue de siete días (IQ: 1,5-33,0). 57,0% recibió alta domiciliar y 26,2% evolucionaron a óbito. **Conclusiones:** Las víctimas de trauma admitidas vía transporte aéreo eran en su mayoría graves y demandaron atención inmediata y especializada, incluyendo propedéuticas y terapéuticas de alta complejidad.

Descriptores: Atención de Apoyo Vital Avanzado en Trauma; Ambulancias Aéreas; Servicios Médicos de Urgencia; Enfermería de Urgencia.

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INTRODUCTION

The International Classification of Diseases (ICD-10), defines the external causes like accidents, intentional self-harm, assaults, events whose intent is undetermined, legal interventions and war operations, complications of medical and surgical assistance, sequelae of external causes of morbidity and mortality, and additional factors related to the causes of morbidity and mortality classified elsewhere⁽¹⁻²⁾. Currently, this condition represents the third leading cause of morbidity and mortality in the world with 8.0% of deaths registered in 2017⁽¹⁾. That same year, 158,657 deaths occurred in Brazil due to external causes, corresponding to 12.0% of the total deaths. The most prevalent causes were those related to trauma due to aggression (40.2%), followed by transport accidents (22.9%), and other external causes of accidental injuries (20.2%)⁽³⁾.

Trauma is considered a great physical impact that results in an abrupt or violent act that causes the damage of varying lengths to the organism, necessary to identify its degree of complexity to establish the individualized therapeutic conduct for each patient⁽⁴⁻⁶⁾. The energy involved in the trauma can characterize polytrauma and result in serious life-threatening injuries^(4,7,8-11).

Early access to adequate care for trauma victims, even in a pre-hospital environment, can reduce mortality and sequels⁽⁷⁻⁹⁾. Traumatic injuries can cause a fast deterioration of the human body and, therefore, we believe that mortality and morbidity increase dramatically, if the victim does not receive definitive medical treatment at a Trauma Center (TC) within one hour after the trauma^(6,9-10).

Assistance in places far from large centers hinders to reach specialized centers for the care of these victims⁽¹¹⁾. In this sense, air transportation is one of the strategies that favor early access to units of greater complexity and that have a surgical room, intensive care, and qualified professionals to intervene in specific situations that aggravate health, significantly improving survival and quality of life of these patients (9-10,12).

At the end of the 1940s, Emergency Medical Helicopter Services (SHEM) were implemented, allowing hospitals to use a new way of patient transportation when the land option was ineffective or unviable^(9-10,12-13). When compared to land transportation, SHEMs have advantages such as increased patient survival by faster transportation time, more experienced health

staff, advanced resources, and early access to TC^(9-10,12). Despite the advantages, its limitations are the high cost, small cabin space, fewer aircraft, and great susceptibility to climatic interference^(10,12-13).

In 2011, the Ministry of Health established in Brazil the Urgency and Emergency Care Network (RUE) of the Unified Health Care System (SUS). The RUE recognizes trauma as one of its priorities and emphasizes the expansion of access and reception of acute cases in all care centers, as well as the integration between them, ensuring universality, equity, and comprehensiveness of actions and care, through the trauma care line⁽⁵⁻⁷⁾. This aims to enable trauma centers, reduce morbidity and mortality, develop actions for the surveillance and prevention, and establish the network of hospital care for trauma, strengthening the policy and the regulated access and qualified at all care centers in the network⁽⁶⁻⁷⁾.

In addition to investing in TC, the RUE proposed the regionalization and expansion of the Mobile Emergency Service (SAMU-192), adding the air transport services for pre- and inter-hospital care⁽⁶⁾.

In Minas Gerais, this type of service was expanded through SAMU-192 and the Battalion of Air Operations of the Military Fire Brigade of Minas Gerais with access to this mode of transportation⁽¹⁴⁾. In this context, one of the state's referral TC has received trauma victims via air transport. These victims have priority transportation as they tend to have more severe conditions but the results of their care are unknown nor is their outcome. Thus, we question what are the characteristics and outcomes of the care provided to trauma victims admitted, via air transport, in a large public hospital of state reference for urgency and emergency.

The nurse is part of the multidisciplinary team that provides assistance to the trauma victim and coordinates the nursing team, in addition to planning and participating in the assistance to be provided, in a scenario in which the time between life and death is tenuous.

Therefore, this study aimed at describing the characteristics of the care provided to trauma victims admitted to a large emergency room via air transport.

We expect that this study will contribute as a reference for future investments in hospital emergency services, possible adjustments in care flows, helping to strengthen public trauma prevention strategies and policies, and evaluating

the service to increase the resolution and quality of care provided to these patients, increasing their chances of survival^(5,7).

METHOD

This is a cross-sectional, retrospective study, developed in the emergency room (ER) of a large public hospital, inserted in the SUS, located in Belo Horizonte, capital of the state of Minas Gerais. The hospital is a reference in the care of patients in urgent situations, victims of polytrauma, major burns, intoxications, and clinical and/or surgical situations with the risk of death. It also has a plan to deal with incidents with multiple victims⁽¹⁵⁾.

The sample consisted of the computerized records of all patients who were admitted to the hospital via air transport in 2018. We included all computerized records of trauma victims admitted to the hospital via air transport and who received initial care at the resuscitation room of the ER.

During the study period, 143 patients were admitted via air transport. Five of them had a clinical reason and 31 did not have data in the hospital's computerized system, they only had a registration form. Thus, the sample consisted of 107 medical records.

Chart 1 shows the variables listed for the study.

Chart 1 – Variables listed for the study. Belo Horizonte -MG -Brazil – 2018.

Study variables	
Identification data	Gender (female/male)
	Age (years old)
Accident data	Trauma mechanism
Transport data	Responsible for air transport (public service/private service)
	Flight time (in minutes)
	Origin of the patient
Hospital care data	Month of admission
	Day of the week
	Service shift: <ul style="list-style-type: none"> ▪ Late night (00:00-11:59) ▪ Morning (06:00-11:59) ▪ Afternoon (12:00-18:59) ▪ Night (19:00-23:59)
	Risk Classification according to Manchester Screening System: <ul style="list-style-type: none"> ▪ Main complaint ▪ Flowchart ▪ Discriminator ▪ Priority level
Initial evaluation on admission according to the ABCDE mnemonic	A- Airway opening and cervical spine control: <ul style="list-style-type: none"> ▪ Perviousness ▪ Airway clearance device ▪ Use of cervical collar
	B- Breath: <ul style="list-style-type: none"> ▪ Spontaneous ventilation ▪ Oxygen administration ▪ Oxygen delivery device ▪ Respiratory frequency ▪ Pulmonary auscultation
	C- Circulation: <ul style="list-style-type: none"> ▪ Heart rate ▪ Cardiac auscultation ▪ Systolic and diastolic blood pressure ▪ Capillary filling time
	D- Neurological dysfunction: <ul style="list-style-type: none"> ▪ Glasgow Coma Scale at the Scene and Admission ▪ Pupillary characteristics in the scene and admission ▪ Direct pupillary light reflection in the scene and admission ▪ Report of loss of consciousness

(Continues)

Chart 1 – Variables listed for the study. Belo Horizonte -MG -Brazil – 2018.

Study variables	
Initial evaluation on admission according to the ABCDE mnemonic	E- Exhibition and the environment: <ul style="list-style-type: none"> ▪ Longboard immobilization ▪ Types of injuries and body regions affected
Propaedeutics and therapeutics	Assistive devices: <ul style="list-style-type: none"> ▪ Peripheral venous access puncture ▪ Monitoring of intra-arterial pressure ▪ Bladder catheterization ▪ Central venous catheter puncture
	Imaging exams requested from the first 24h
	Results of the imaging tests requested for the first 24 hours
	Reserve blood products in the first 24 hours
	Type of blood products transfused in the first 24 hours
	Instituted therapy (surgical/conservative)
Outcome	The outcome in the ER (discharge to home, Surgical Unit, Intensive Care Unit, inpatient unit, transfer to another hospital, death)
	Time spent in the ER (in hours)
	Hospital outcome (discharge to home, transfer to another hospital, death)
	Length of hospital stay (in days)

Source: elaborated for this study.

Regarding the trauma mechanism, burn victims patients were classified as severity, according to the classification of the burned body surface (BBS): small burn (1st and 2nd degree up to 10% of BBS), medium burn (1st and 2nd degree between 10 to 25% of BBS; 3rd degree up to 10% of BBS, burns of hands, feet, and face) and major burn (1st and 2nd degree above 26% of BBS; 3rd degree above 10% of BBS and/or perineum, electrical burns, airways, and presence of comorbidities)⁽¹⁶⁾.

The data related to the risk classification (RC) considered the variables of the Manchester Screening System (MSS). In the MSS, the main complaint was the choice of a flowchart that indicates the evaluation of signs and symptoms, using discriminators that determine a level of clinical priority for the first medical care. The MMS priority levels include: 1-emergency (red), 2-very urgent (orange), 3-urgent (yellow), 4-little urgent (green) and 5-non-urgent (blue). For each priority, there is a maximum waiting time for the first appointment, being 0, 10, 60, 120, and 240 minutes, respectively⁽¹⁷⁾.

The sequence of the primary evaluation of trauma patients should be based on the sequence of the mnemonic ABCDE. These letters indicate the sequence of the evaluation and guide the professional's care to prioritize the treatment of injuries that threaten the patients' lives^(7,18).

In the neurological evaluation, the Glasgow Coma Scale (GCS) is recommended to assess the victim's level of consciousness. This scale defines a score that can vary from three (very compromised level of consciousness) to 15 points (preserved

level of consciousness). Three parameters are evaluated (eye-opening, best verbal response, and best motor response) and the score in each of them refers to the best response presented by the patient^(11,19).

For data collection, we elaborated on an instrument that contemplated the study variables. The researchers carried out the collection from July to December 2019 and took place in two stages. The first, consulting the hospital's specific registration form, completed for patients who were admitted via air transport to the resuscitation room, in which data were collected regarding the registration, the demographic and clinical characteristics of the patients, and transportation data. From the data in the registration form, the second stage consulted the electronic medical records provided by the hospital's computerized management system for the collection of variables related to risk classification data, hospital care, initial assessment at admission, propaedeutic, therapeutic, and outcome of care.

After registering the variables in the collection instrument, the information was transcribed to a database created in the Epidata 3.0 software, using the double-entry technique to reduce the chances of wrong entry. Subsequently, we exported the data to the software Statistical Package for the Social Sciences (SPSS) version 25.0 and submitted the data to descriptive statistical analysis. For quantitative variables, we determined measures of central tendency (mean and median) and dispersion measures (minimum, maximum, and interquartile range - IQ). The Kolmogorov-

Smirnov normality test evaluated the quantitative variables to define the use of means or medians in the presentation of data. Categorical variables were presented as absolute and relative frequencies.

This study was based on Resolution 466/2012 and 510/16 of the National Health Council. The research project was authorized by the Ethics Committee of the Hospital Foundation of the State of Minas Gerais (FHEMIG), CAAE: 15886919.6.0000.5119, approved with opinion number: 104/2019.

RESULTS

Most of the 107 patients analyzed were male (68 - 63.6%), aged from zero to 87 years old, with a median of 32 years old (IQ: 23 - 51).

Car crash was the most frequent trauma mechanism (30 - 28.0%), followed by vehicle rollover (23 - 21.5%), burns (17 - 15.9%), fall in means of transportation (13 - 12.1%). The others had percentages lower than 10.0% and included: run over, physical aggression, and falling from a height. Prehospital public air transport was responsible for 92 (86.0%) services. The flight time varied from three to 100 minutes with a median of 14 minutes (IQ: 10-26).

The origin of most of the victims (87 - 81.3%) was from the city of Belo Horizonte and the metropolitan region. Figure 1 shows the origin distribution, according to the state region.

Figure 1 - Distribution of trauma victims admitted via air transport according to the origin. Belo Horizonte - MG - Brazil, 2019.



Source: Prepared for this study from the cartographic base of the Brazilian Institute of Geography and Statistics – IBGE.

Hospital care data

October (20 - 18.7%) was the month with the highest number of admissions, followed by December (15.0 - 14.0%) and January (12 - 11.2%). The other months showed a similar percentage with less than 10.0%.

Regarding the day of the week, the largest number of admissions was on Saturdays (23 - 21.0%) and Sundays (23 - 21.0%), followed by Monday (16 - 15.0%) and Tuesday (15 - 14.0%). The remaining days of the week had a percentage lower than 10%. The afternoon was the shift with the highest number of admissions (75 - 70.1%), followed by the morning (19 - 17.8%) and the night (13 - 12.1%).

There were no records of RC data in 46 (43.0%) medical records. Regarding the main complaint, 15 (24.6%) were due to car collision, 12 (19.7%) were burned, 11 (18.0%) were vehicle rollover, 11 (18.0%) were motorcycle collision and the others had a percentage lower than 10.0% for the variable. There was a report of more than one main complaint by the same patient.

The 'Major trauma' flowchart was described in 19 (31.1%) records, followed by 'Burns' (6 - 9.9%). Among the classified patients, 36 (59.0%) did not have a flowchart. The discriminator of 'significant trauma mechanism' was the most frequent (11 - 18.0%), followed by 'inadequate breathing' (7 - 11.5%), the others (9 - 14.8%) presented percentages less than 10%. Among the classified patients, 34 (55.7%) had no registered discriminator. The level of clinical priority varied between emergency-red (34 - 55.7%) and orange (25 - 41.0%) and in two medical records (3.3%) did not have records of the clinical priority level.

Initial evaluation at admission

A- Airway and cervical spine control

The airway (AW) was pervious in 106 (99.1%) cases, but there was one (0.9%) report of AW obstruction related to esophageal intubation. Regarding the AW clearance device, 59 (55.0%) cases reported the use of the orotracheal tube.

The use of the cervical collar as an alignment and stabilization device for the cervical spine was described in 83 (77.6%) records and 14 patients (13.1%) did not use it on admission to the emergency room. In ten medical records (9.3%) there was no report on the use of this device.

B- Ventilation

Spontaneous ventilation was impaired in 59 (55.0%) patients and 73 (68.2%) received supplemental oxygen. Among the oxygen delivery devices, the mechanical ventilator (58-79.5%) prevailed, followed by a face mask with a non-rebreathing reservoir (10 - 13.7%) and a nasal catheter (5 - 6.8%).

The respiratory rate (RF) varied from 0 to 32 respiratory incursions per minute (ripm), with a median of 18ripm and (IQ: 16 - 20). More than half of the patients (67 - 62.6%) had physiological breath sounds (PBS) on pulmonary auscultation, 12 (11.2%) had decreased PBS, two (1.9%), diffuse crepitus 1 (0.9 %) bilateral diffuse snores and in 25 (23.4%) medical records there was no record of this variable.

C- Circulation

Heart rate (HR) ranged from zero to 173 beats per minute (bpm) and had a median of 96 bpm and (IQ: 79 - 110). In cardiac auscultation, normorhythmic and normophonetic sounds in two stages were described 68 (64.0%) times and in 39 records (36.0%) there was no description of this variable.

Systolic blood pressure (SBP) ranged from 0 to 180mmHg, with a median of 120mmhg (IQ: 103.0-130.0). Diastolic blood pressure (DBP) ranged from 0 to 120 mmHg, with a median of 71 mmHg (IQ: 58 - 81).

The capillary refill time was less than three seconds in 45 (42.0%) cases and greater than three seconds in five cases (4.7%). In more than half of the medical records (57 - 53.3%), there was no record of this variable.

D- Neurological dysfunction

The GCS in the scene varied between 3 and 15 points, with a median of 10 points (IQ: 6 -15). There was no data in 48 (44.0%) records.

The characteristics of the pupils in the scene were isochoric in 23 (21.5%) patients, with anisocoric in three (2.8%), and mydriatic in one patient (0.9%). In 80 records (74.7%), there was no description of this variable. Regarding the direct pupillary light reflex test, on the scene, 23 patients (21.5%) had bilateral pupillary reactivity and in 84 medical records (78.5%), there was no record of this information.

The report of loss of consciousness at the scene was described to 24 (22.4%) patients, 16

(15.0%) did not lose consciousness and was not reported in 67 (62.6%) medical records.

GCS at admission ranged from 3 to 15, with a median of 15 (IQ: 9-15), but there was no record in 43 (40.2%) records.

The characteristics of the pupils at admission were isochoric in 60 (56.1%) patients, miotic in 16 (14.9%), anisocoric pupils in 9 (8.4%), and mydriatic in 8 (7.5%). There was an absence of registration of this variable in 14 (13.1%) records. Regarding the pupillary light reflex test, 71 (66.3%) patients had bilateral pupillary reactivity, eight (7.5%) had no pupillary reactivity, bilaterally, in three (2.8%) the reactivity was unilaterally absent and in 25 (23.4%) there was no record of this variable.

E- Exhibition and environment

Most patients (91 - 85.0%) were admitted immobilized on a longboard, four (4.0%) were immobilization on their upper limbs, and six (6.0%) immobilized on their lower limbs.

Table 1 shows the data regarding the types of injuries and body regions affected.

Table 1 - Types of injuries and affected body regions of trauma victims admitted to an emergency room via air transport. Belo Horizonte - MG - Brazil - 2018. (N=107).

Types of injuries	N	%
Abrasion	36	33.6
Cut-contusion wound	33	30.8
2 nd and 3 rd degree burn	19	17.7
Traumatic tattoo	12	11.2
Blepharohematoma	11	10.2
No medical record	10	9.3
Body regions affected		
Limbs	71	66.3
Skull	62	57.9
Chest	44	41.1
Face	18	16.8
Abdomen	18	16.8
Cervical spine	12	11.2
Spine	11	10.2
No medical record	4	3.7

Source: elaborated by the authors.

Among the burned patients, we observed that most of them (16 - 84.2%) were classified as major burned.

Propaedeutics and therapeutics

The most frequent procedures performed on the admission of patients was the peripheral venous access (PVA) puncture in 93 patients (87.0%), followed by bladder catheterization in 61

(57.0%), central venous catheter insertion (CVC) in 32 (30.0%) and intra-arterial pressure monitoring in 25 patients (23.0%).

Table 2 shows the data relating to the imaging tests requested in the first 24 hours and their respective results.

Table 2 - Distribution of imaging tests and respective results requested in the first 24 hours for trauma victims admitted to an emergency room via air transport. Belo Horizonte - MG – Brazil - 2018. (N=107).

Imaging exams requested first 24h	N	%
Tomography	78	72.9
Radiography	72	67.3
Focused Abdominal Sonography for Trauma	46	43.0
Tomography		
Skull	68	63.5
Cervical spine	66	61.7
Chest	49	45,8
Abdomen	48	44.9
Pelvis/Basin	48	44.9
Sacred loin column	30	28.0
Thoracic spine	28	26.2
Face and sinuses	11	10.3
Radiography		
Chest	60	56.0
Pelvis/Basins	32	30.0
Arm	23	21.5
Leg	20	18.7
Thigh	16	14.9
knee	11	10.3
Imaging results		
Intracranial hemorrhage	45	42.0
Limbs Fracture	30	28.0
Spine fracture	29	27.1
Fracture of coastal arches	18	16.8
Pneumothorax/Hemothorax	17	15.9
Skull fracture	14	12.1
Fracture of the facial bones	12	11.2
Cerebral contusion	11	10.2
Pulmonary contusion	10	9.3
Without changes	3	2.8

Source: elaborated by the authors.

Reserves of blood products to the blood bank were requested for 59 (55.1%) victims: red blood cell concentrate (59 - 55.1%), plasma (53 - 49.5%), platelets (23 - 21.5 %) and cryoprecipitate (8 - 6.5%). The ones effectively transfused were red blood cell concentrate (25 - 23.4%), plasma (10 - 9.3%), platelets (5 - 4.7%) and cryoprecipitate (8 - 6.5%).

The type of therapy instituted was absent in eight medical records (7.5%). The surgical approach predominated (65 - 60.7%) followed by the conservative 34 (31.8%). The length of stay of patients in the ER ranged from 16 minutes to 269 hours to 25 minutes with a median of 9 hours and

52 minutes, (IQ: 3 hours and 34 minutes - 29 hours and 55 minutes).

As a result of the ER, half of the patients (54 - 50.5%) were referred to the operating room, 13 (12.1%) died, 12 (11.02%) were discharged to their home, 11 (10.3%) were referred to the ICU, nine (8.4%) to an inpatient unit and eight (7.5%) were transferred to another hospital unit.

The length of hospital stays ranged from 0 to 301 days with a median of 7 days (IQ: 1.5-33.0). In the hospital outcome, more than half (61 - 57.0%) were discharged to their home, 28 (26.2%) died and 18 (16.8%) were transferred to another hospital.

DISCUSSION

The predominance of men and the mechanism of car trauma has been highlighted in other studies with trauma victims. This is a pattern that is repeated nationwide^(4-8,10,13). This finding may be related to the increase in the consumption of alcohol and drugs, greater ease in the acquisition of vehicles, as well as factors related to culture and recklessness in traffic laws^(4-5,7,8,13).

The median age of patients was 32 years old, an age that represents an economically active population^(4,6-8). Characteristics of this age group, such as driving inexperience, immaturity, the association between drug use and driving, and other risk behaviors are some of the factors that may be linked to these statistics. Other studies pointed to the same result for this variable^(5-6,8,10,13,20). The victimized patient may also experience an interruption in his productive activities, economic loss, failing to generate income, requiring the use of the social security service^(5,8,20).

Half of the air transport was carried out in 14 minutes or less. The assistance in a short period after the occurrence of traumatic injuries can be the biggest factor associated with the reduction of mortality because the faster the victims are rescued the sooner the diagnosis is established and the treatment is started^(4, 9,10). In this way, air transport can contribute to reducing response time and access to specialized medical services^(4,9-10,12,13).

A study that validated a medical screening protocol for trauma patients to define the need for air transport showed an increase in the survival rate of 22% of those whose means of transportation were indicated⁽⁹⁾. Although air transport has shown benefits in terms of survival rate, the selection of patients selected for this transport mobility is still a challenge.⁽⁹⁻¹⁰⁾

It is necessary to transfer patients in serious condition on time since the definitive treatment for cases of hemorrhagic hypovolemic shock requires surgical intervention and/or infusion of blood components, procedures currently available only at the tertiary level^(6, 9-10,21). The infusion of colloids and crystalloids in pre-hospital care is a temporary intervention to ensure adequate perfusion of the organs; however, it does not ensure adequate oxygen transport in cases of blood loss⁽²¹⁻²²⁾.

The predominance of the metropolitan region of Belo Horizonte in the analysis of the origin of patients, we should consider the

regionalization of health services within the scope of SUS, with the provision of care centers with various levels of care at strategic points⁽²⁰⁾. Belo Horizonte is considered a state center of Minas Gerais (MG) and is also a macro-regional center of reference for the metropolitan administrative regions of MG⁽²³⁾.

The period related to long holidays and school holidays were the months with the highest prevalence of admissions, periods in which the number of trips significantly increased and there is the greatest chance of car accidents. The occurrence of a greater number of admissions on weekends and in the afternoon was similar in other studies on the subject^(4,8,13,20). The prevalence of admissions these days may be related to the consumption of alcoholic beverages, which is associated with cognitive changes, violent behaviors, and inappropriate traffic behaviors^(5,8,13,20).

The low incidence of admissions at night may be related to the fact that most aircraft need to fly in favorable climatic situations and do not travel by instrument, which restricts traffic at this time and during the occurrence of rains^(12,22).

As for the risk classification data, the fact that almost half do not have these records can be attributed to the way the patient enters the institution, that is, he does not pass through the physical space for the classification, implying in the absence of this important record.

The greater frequency of access to the 'major trauma' and 'burn' flowcharts is in line with the most prevalent trauma mechanisms and main complaints presented by the population studied. The higher frequency of discriminators 'significant trauma mechanism' and 'inadequate breathing' was consistent with clinical priority levels that indicated immediate medical care or within ten minutes. Due to the insufficiency of RC records, it is not possible to affirm the occurrence of a higher level of severity in these patients. However, based on classified patients, we observed the need for immediate, specialized medical care, and more advanced treatment resources in a reference center, which corroborates the indication of aeromedical transport.

Regarding the initial evaluation of the trauma victim, more than half were admitted with an airway prosthesis. The use of artificial airways is indicated when manual airway clearance techniques fail, in unconscious patients and/or with severe depression of the level of

consciousness, which can be considered when reaching a score ≤ 8 on the GCS^(7,22,24). This fact shows the high degree of complexity of these patients. Orotracheal intubation is the preferred method for controlling airways, as it significantly decreases the risk of bronchoaspiration, facilitates deep aspiration, prevents gastric insufflation, and allows an access route for medication administration⁽²¹⁾.

The use of the cervical collar associated with lateral blocks to immobilize the head aims to prevent injury secondary to the cervical spine⁽⁷⁾. The absence of these devices in some patients may be related to recent scientific evidence discussions that advocate the discriminated use of these devices in the cases indicated⁽¹⁸⁾. The cervical collar is not indicated in non-intoxicated patients, without cervical pain and/or cervical stiffness, without the neurological deficit and distracting factors, such as severe pain in other regions of the body^(07,18). It may also be related to previous evaluation in other health institutions that would rule out cervical injuries, but this study does not provide enough information to confirm this hypothesis.

The administration of supplemental oxygen with a flow of 10L/min to the trauma victim is indicated to maintain tissue oxygenation greater than 95%, and it is one of the objectives of the initial care being the trauma victim^(7,22,24). The administration of oxygen under a face mask or by a mechanical ventilator is indicated for all traumatized patients with or without spontaneous breathing who will be submitted to air transport due to the possibility of hypoxia during the flight caused by the decrease in the partial pressure of O₂ with elevation in altitude, which corroborates data from this study⁽²²⁾.

Half of the patients had tachypnea, which may also be related to the ventilator parameters, as 79.5% of the patients were on mechanical ventilation. Tachypnea is vital data that indicates insufficient tissue oxygenation and/or increased tissue metabolism, which results in increased anaerobic cell respiration and, consequently, increased CO₂^(7,21,24). The respiratory center recognizes the high level of CO₂ and increases RF, in an attempt to eliminate this excess gas^(7,21,24). Therefore, RF is vital data that can early indicate deficits in perfusion, tissue oxygenation, or both^(21,24).

In cases in which there was a decrease in the auscultation of physiological breath sounds, we can infer that the pain resulting from chest trauma

can result in a decrease in chest expansion and, consequently, in a decrease in these sounds during auscultation^(12,22). Also, the lack of information regarding this variable can hinder the early detection of pneumothorax and/or hemothorax and the establishment of immediate diagnosis and interventions^(4,12-13,22).

Hypertensive pneumothorax, open pneumothorax, massive hemothorax, and unstable chest require early diagnosis and immediate interventions, as they can compromise ventilation and generate an immediate risk of death^(4,12,22).

As for the circulatory status, we noticed that more than half of the patients showed signs of hemodynamic stability. The high values of systolic and diastolic pressures in 50% of the cases can be related to the exposure and manipulation of the victims and the stress situation, for receiving care in an unknown environment. However, patients who are victims of multiple trauma are more susceptible to the occurrence of circulatory shock, especially hypovolemic shock⁽²¹⁾.

In trauma victims, the evaluation of the level of consciousness using the Glasgow coma scale (GCS), pupillary evaluation, pupillary light reflex, and history of loss of consciousness determine the level of brain function and predict the level of severity and survival⁽⁷⁾. Thus, it is essential to know the result of their evaluation at the scene and on admission, as these data directly affect the priority of transportation of these patients, the activation of resources such as air transport, as well as in-hospital management^(6, 12).

In this study, half of the patients had an GCS score of less than 10, indicating severe conditions with a potential need for airway prosthesis. The oro-tracheal intubation is indicated for patients with a decreased level of consciousness (GCS ≤ 8) and who do not protect the airway⁽⁷⁾. Therefore, this fact can justify the prevalence of admissions of patients with oro-tracheal intubation and mechanical ventilation^(12,22,24).

The lack of recording of the GCS score on admissions can be explained by the possibility that patients had received some type of sedation in pre-hospital care, for performing oro-tracheal intubation and ventilation adjustment. This makes the use of the GCS unfeasible, indicating for these cases, the use of scales that assess the level of sedation, not described in most admissions. Given these circumstances, the relevance of recording the GCS score in the initial evaluation of pre-hospital care is emphasized. This data can assist in

the proper management of this patient at the intra-hospital level^(6,7,12,22).

When patients are admitted, the evaluation of the pupils helps to define the level of severity, neurosurgical conduct, and the prognosis of victims of TBI^(7,22). The decrease in the level of consciousness associated with abnormal pupillary reflex can indicate potentially fatal brain injuries⁽⁷⁾. In this study, well less than half of the medical records had this evaluation. Given the seriousness and the need for an early approach, it is a result that needs to be disclosed so that the services involved rethink the protocols for care and training of health teams.

Regarding the immobilization of patients, despite the recommendations for the use of a longboard and cervical immobilization for all trauma victims⁽¹¹⁾ some patients could receive first care at other institutions, with imaging exams and medical evaluation excluding spinal injuries, which would justify not using these devices for air transport.

A study that evaluated interventions in trauma victims, in the period before aeromedical transport⁽²²⁾, presented immobilization data similar to this study. Keeping the patient on a longboard during air transport promotes stabilization of the victim, decreases the risk of secondary spinal injuries, decreases discomfort, increases safety during the flight, and minimizes gravitational effects^(18,22).

The lower and upper limbs, the skull, and the thorax were the body regions most affected. The lower limbs contain the longest bones in the body, therefore, after a car collision, they are the bones receiving the most energy dissipation^(7,11). On the other hand, the upper limbs are related to the defense mechanisms of human beings to mitigate the impact⁽¹¹⁾. A review study on the theme of this research showed that fractures and traumatic brain injury (TBI) were the most frequent injuries⁽⁸⁾. TBI was also the main trauma mechanism in a documentary, qualitative, retrospective study that characterizes the profile of occurrences in an air medical transport⁽¹³⁾.

Burns were the third most common type of injury in the sample studied, most of them as the major burns. We know that the researched institution is a state reference in the care of these patients, having a burn treatment unit with an intensive care unit and a specific surgical room for these patients. This characteristic allows care in a differentiated environment and greater protection

against secondary infections, a complication of great risk due to the involvement of the skin in large bodily areas⁽¹⁶⁾.

The peripheral venous access (PVA) was the most prevalent procedure performed. It is a route of rapid administration of fluids and drugs⁽²²⁾. The need for its use in trauma victims is because of the chance of shock and the need to infuse intravenous and blood products⁽⁷⁾.

Imaging exams were performed in more than half of the patients, with tomography and radiography as the most prevalent. The results of imaging tests are diagnostic definers, indicating the level of severity of the lesions and also assisting in the establishment of conducts and immediate treatment⁽¹⁹⁾. The costs of performing tomography are high and this type of exam is not available at all levels of care, nor in all hospital institutions, justifying, once again, the need for early transportation of these patients to a reference institution^(8,19).

Intracranial hemorrhage, limb fractures, and spine fractures were the most frequent results of imaging studies. These results are following the indication of air transport, as well as the level of severity of these victims and the need for specialized care⁽¹¹⁾.

The surgical was the most frequent type of therapy as it proves the need for access to highly complex units^(11,19).

As for the length of stay, half of the patients remained in the institution for less than seven days. A similar study carried out in a TC, in Rio de Janeiro, showed a higher average hospital stay (11.4 days)⁽⁶⁾. Extended periods of hospitalization predispose to the occurrence of adverse events and other complications. These factors, associated with the constant overload of the service, can burden the health system and impact the country's productive, economic, and social process^(6,8).

A study carried out in the USA comparing the average length of stay of patients transported by air and land showed that patients with access to air transport had a higher average hospital stay and in Intensive Care, showing the severity and justification of early access to specialized services.

The percentage of deaths as an outcome of hospitalization found in this study is a worrying fact. A similar study indicates a lower death rate⁽⁶⁾. However, access to TC via air transport may have contributed to the hospital discharge that occurred in more than half of the victims. A retrospective multicenter study that evaluated the difference in

outcome between trauma victims transported by land and air carried out in the United States of America (USA) showed that patients who were transported by helicopter were 57% less likely to die than those transported by land ambulances (95% CI, $p < 0.001$)⁽¹⁰⁾.

This study did not evaluate the quality of life, nor functional functions after discharge. We suggest to carry out studies with more robust designs that evaluate the survival of this population after hospital discharge, as well as the quality of life and functional disabilities acquired by a trauma⁽⁵⁾.

Although the results evidenced by the study are relevant, it has limitations related to the incomplete and incorrect registration of essential data for statistical surveys, both in the forms of patients admitted to the helipad and in the computerized medical record of the institution. The insufficient registration of professionals involved in the care of these patients reflects that care is not always properly documented, which compromises several institutional processes such as the reformulation of protocols and flows and studies with a retrospective approach.

Due to the significant absence of records regarding life habits, and especially in the use of legal and illegal drugs, we made associations between car accidents and their use for this specific population.

CONCLUSION

From the analysis of the characteristics of the care provided to trauma victims admitted via air transport, we identified that the trauma victims admitted via air transport were mostly severe and demanded immediate and specialized care, including high complexity propaedeutic and therapeutic treatments. More than half of the population was male and the economically active age group. Car collision was the main mechanism of trauma, and most of them required imaging tests and surgical treatment of injuries. Seven days was the median length of stay. More than half were discharged to the home; however, there was a high death rate.

Knowing the profile and conditions of admission and treatment of these patients contributes to rethinking the preparation of the health team, the improvement of the articulation between the units and services, the establishment of referral and counter-referral flows, the investment in permanent and continuing education, also, to better dispose of intra- and

extra-hospital resources, such as air transport, to make service more agile and effective, reducing costs and disabilities. The results of this study can also support the improvement of preventive measures to trauma, strengthening the state policy of care to external causes and trauma care line, contributing to the control of this event.

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